APPENDIX D

SOCIOECONOMIC ANALYSIS

Draft Environmental Impact Statement
Allocation of Water Supply and
Long-Term Contract Execution
Central Arizona Project

Central Arizona Project Allocation
Draft Environmental Impact Statement
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APPENDIX D SOCIOECONOMIC ANALYSIS

D.I. PURPOSE AND OBJECTIVES OF SOCIOECONOMIC STUDY

The purpose of this study is to estimate the social and economic impacts of a reallocation of CAP water in accordance with a negotiated settlement and with other potential alternative allocations in the event a negotiated settlement is not achieved. Specifically, this appendix focuses on the incidence of these impacts on non-Indian and Indian agricultural production in Pinal, Maricopa, and Pima Counties from 2001 to 2051. In addition, this study examines the effect upon the entire economy of the three-County area and Pinal County alone, when changes in agricultural production occur. Impacts to agriculture and to the entire three-County economy are examined by observing changes in industry output, employment, and income for agriculture in the three-County economy and in the Pinal County economy.

The objectives of this study are:

- To quantify potential changes in agricultural production and associated changes in employment, income, and other economic measures under the allocation alternatives;
- To estimate the timing of potential changes in agricultural production;
- To identify the economic linkages between agriculture and other industrial sectors in the three-County area and within Pinal County;
- To quantify potential primary and secondary impacts to the three-County economy and Pinal County economy due to changes in agricultural production;
- To determine the economic importance of agriculture in the three-County economy and in the Pinal County economy in terms of output, employment, and income.

D.II. PLAN OF STUDY

To estimate the potential economic impacts to agriculture under each alternative, a model specific to the three-County economy and the Pinal County economy was created using an economic input-output model known as IMPLAN.[1] IMPLAN allows for the construction of a regional input-output model to assess the potential economic impacts of alternative resource management strategies.[2] Arizona State-and County-level data for agricultural output and prices were incorporated into the IMPLAN database to more accurately reflect the economy of central and southern Arizona. A model was created of the three-County economy and another model of the Pinal County economy, for 2001, to represent baseline conditions. Under each alternative water reallocation, six models were created to illustrate the condition of the economy at six points in time during the study period. These additional models were created to

[1] Minnesota IMPLAN Group, Inc., IMPLAN System (1997 data and software), 1940 South Greeley Street, Suite 101, Stillwater, MN 55082, www.implan.com, 1997.
[2] Ryan, Lisbeth A., The Economic Impacts of River Running in Northern New Mexico, Unpublished Master of Science Thesis, University of Arizona, Tucson, Arizona, 1994.

observe the timing of impacts on agriculture and the rest of the economy within the study area. Within each alternative, the models developed to represent economic conditions at specific points in time were adjusted with agricultural output data developed by the analysts. In addition, investment values for projected Federal construction expenditures on Indian lands were incorporated into the model.

In this study, non-Indian and Indian agriculture in the three-County area is composed of seven CAP IDs, two other IDs, and two Indian communities. By County, the CAP IDs and Indian communities are:

Pinal County - MSIDD, CAIDD, SCIDD, HIDD, NMIDD, TON Chuichu District, and the GRIC.

Maricopa County - QCIDD, HVDD, TIDD, and RID.
Pima County – TON, Schuk Toak, and San Xavier Districts.

The SC Apache Tribe is not included in this study, since the new agricultural development on the Reservation resulting from these CAP allocations would be outside the three-County area. A separate analysis for the social and economic impacts of new farm development on the SC Apache Tribe Reservation has been carried out, using data from Gila County. The economic and social impacts of delivering additional CAP water to the Navajo / Hopi Tribes for M&I use under Alternatives 2 and 3 are also described separately in Chapter 3 and in Appendix L.

RID and SCID are not analyzed because, over the study period, no change in output is projected to occur in these IDs due to water price. Groundwater pumping costs in RID and SCID are sufficiently low so that farmers' total water costs do not become too high for the cultivation of certain crops even when availability of CAP excess water declines.

CHCID and STIDD are not analyzed because those districts cultivate predominantly high value crops which are not sensitive to the range of water prices examined in this study. Therefore, no crop acreage is projected to go out of production in these districts due to increases in water price.

The crops to be covered in this study are cotton, food grains and feed grains (grains), hay and pasture (forage), vegetables and melons (vegetables), and trees and vines (trees). Partial farm budgets are developed for cotton, grains, and forage to determine the maximum water cost a farmer can pay and still produce a particular crop. When the price of water exceeds the maximum water cost a farmer can pay, a crop is taken out of production. Once crop acreage is assumed to go out of production, it is assumed to remain out of production for the remainder of the study period. The primary focus is on cotton, grains, and forage because these crops have lower earnings per af of water than fruit, vegetable, and nut crops and, therefore, are more vulnerable to changes in water costs. The decrease in production of a particular crop is reflected in the IMPLAN model by decreasing output in dollars in the appropriate sector equal to the value of the lost production. Employment, by number of jobs, and income decline accordingly. Similarly, in the case of increasing production on Indian Reservations, the gross output of particular crops is added to the appropriate sectors, and employment and income increase accordingly. The data from all of the model runs will be compared to the baseline conditions.

D.III. GENERAL ASSUMPTIONS AND DATA SOURCES

D.III.a. Crop Patterns, Yields, and Prices

Crop patterns, yield per acre, and prices are assumed to remain constant for non-Indian and Indian agricultural output for all alternatives during the study period.

Crop patterns for the CAP IDs in this study are based on historical crop patterns in central Arizona which were reported by IDs to Reclamation for the 1996, 1997, and 1998 crop census. Cropping patterns for Indian agriculture come from a variety of sources.[3] Yield data are based on five-year average County level yields from 1993-1997. Prices are based on five-year average State-wide prices for Arizona for the period 1993-1997. The yield and price data are published in the 1999-2000 University of Arizona (UofA) Field Crop Budgets.

D.III.b. CAWCD Excess Water Pools and Pricing

The assumptions were based upon the January 14, 2000 CAWCD memorandum which provides advisory prices for CAP water from 2001 through 2010.

D.III.c. Groundwater Pumping Costs

Groundwater pumping costs, for 1994 through 1998, were published in UofA Field Crop Budgets in 1994, 1996, and 1998. The average of the UofA pumping cost estimates for five years was used to represent groundwater costs in each district. Assumptions for groundwater costs are further discussed in Section 5.

D.III.d. Input-Output Modeling Assumptions

- Constant returns to scale. Production functions for each industry are linear. All inputs increase proportionately if additional output is required.
- No supply constraints. Industries have unlimited access to raw materials for production.
- Fixed commodity input structure. Changes in the economy will affect the industry's output but not the mix of commodities and services it requires to make its products.
- Homogenous sector output. Proportions of all commodities produced by an industry remain the same, regardless of total output.

[3] GRIC cropping patterns are based on enterprise crop budgets in, "Cash Flow Analysis Pima-Maricopa Irrigation Project, GRIC, U.S. Bureau of Reclamation, November 1997. San Xavier cropping pattern data are based on the San Xavier Development Plan, dated January 1989. Due to an absence of documentation, Chuichu cropping patterns reflect cropping patterns in the CAIDD. Cropping patterns for Schuk Toak are based on information in the Small Reclamation Project Act Loan Application Report for Distribution Systems for Schuk Toak District, dated March 1998.

- Industry technology assumption. An industry uses the same technology to produce all its products.

D.IV. INPUT-OUTPUT MODELS

D.IV.a. Purpose and Application

Input-output analysis attempts to quantify, at a point in time, the economic interdependencies of an economy.[4] Input-output models are utilized to predict economic changes in a specified area or at the national level which arise due to industry relocation, military base closings, and implementation of new or modified natural resource policy. Input-output models may also be used to calculate the contributions of an industry to the local economy.

D.IV.b. Interpreting Economic Impacts with IMPLAN Data

As stated above, input-output models such as IMPLAN were developed to predict, in quantitative terms, how an economy may respond to exogenous changes in one or more economic activities. The IMPLAN model is also descriptive; it provides information about each industrial sector within an economy including the sector's size, behavior, and interaction with other industrial sectors in the economy. The relative importance of each industrial sector is generally reflected in terms of the dollar value of its sales and wages and in terms of number of jobs generated. At the State and County level, there are three types of data that are indicative of economic activity. In this study, we rely on these three data elements to reflect potential economic impacts associated with the reallocation of CAP water.

- Industry Output is defined as a single dollar value that represents each industry's total production. During the study period, depending upon water availability, pricing, and energy costs, we will estimate industry output for the relevant agricultural sectors and observe how increases or decreases in output in these agricultural sectors affect total output, employment, and income for Pinal County and Pinal, Maricopa, and Pima Counties combined.

- Employment is reflected as a single number of jobs for each industry.

- Income is defined as a dollar value that includes payroll costs and employee benefits; proprietary income received from self-employed workers; and other property income such as rents, royalties, and dividends.

- We will examine the data elements identified above in terms of direct, indirect, induced, and total effects to better understand the incidence of economic impacts. In the summary tables presented under Section 8, the sum of indirect and induced effects is referred to as secondary impacts.

[4] Hastings, Steven E. and Sharon M. Brucker, "An Introduction to Regional Input-Output Analysis," Chapter One in Microcomputer-Based Input-Output Modeling Applications to Economic Development, Daniel M. Otto and Thomas G. Johnson, Editors, Westview Press, 1993.

- Direct Effects are the changes in the industries to which a final demand change was made, for example, the total revenues from cotton received by farmers.

- Indirect Effects are the changes in inter-industry purchases as they respond to the new demands of the directly affected industries, for example, the effects that result from businesses purchasing goods and services from other businesses to meet the demands of cotton farmers.

- Induced Effects reflect changes in spending from households as income increases or decreases due to the changes in production, for example, the effects resulting from the expenditures made by households receiving wages and salaries earned to meet the demands of cotton farmers.

- Total Effects are the sum of the direct, indirect, and induced effects.

The definitions of direct and indirect effects provided above are to be used only within the context of regional economic input-output analysis in this appendix. "Direct effects" and "indirect effects" are defined differently in other parts of this Draft EIS.

D.IV.c. Preparing the IMPLAN Model for this Study

The models were constructed with IMPLAN County-level databases for Pinal, Maricopa, and Pima Counties. One model is composed of the three-County-level databases. The second model is composed of the Pinal County database only. The Pinal County economy was modeled by itself because Pima and Maricopa Counties are larger, more urbanized economies whose results tend to overshadow the impacts occurring within the Pinal County economy. When the models were created, IMPLAN generated social accounts, which describe the transfers of money between industries and consumers, and multipliers which predict total regional activity based on a change in consumption. The models were then customized and edited for local output, value added components, and employment for the cotton, grains, forage, vegetable, and tree crop sectors. These adjustments were made with Arizona State- and County-level agricultural data published by the Arizona Agricultural Statistics Service and the UofA. The data represent a five-year average for yield and prices from 1993 to 1997.

D.IV.d. Points in Time for Observations

Six points in time were considered relevant for this analysis. These future dates represent the incidence of significant impacts associated with the water availability and pricing.

- 2001 is the beginning of the study period.

- 2004 is the beginning of CAWCD's new agricultural water pricing and marketing program that is associated with the preferred alternative.

- 2017 represents the expected termination of the AWBA program and discontinuation of in-lieu water available to irrigators.

- 2030 marks the end of CAWCD's current/stated CAP agricultural water marketing and pricing program.

- 2043 is significant because, in this study, shortage conditions are assumed to exist on the Colorado River. Thus CAP water deliveries decrease from 1.4 mafa under normal conditions on the Colorado River to 925,000 afa under shortage conditions. Additional information is contained in Appendix A.

- 2051 is the end of the study period.

D.IV.e. An Example of IMPLAN Results

Utilization of IMPLAN to evaluate economic change results in a variety of economic impacts. Three indicators of economic impacts, output, employment, and income have been selected for this study. Typical results are provided on a series of four tables identified as Tables D-I, D-II, D-III, and D-IV. The tables reflect economic impacts for the three-County area in 2017 under the Settlement Alternative. Production and income data are presented at current price levels. The IMPLAN model was not adjusted for inflation.

Table D-I, the Output Impact Table, shows the direct, indirect, induced, and total effects, which were defined earlier. Changes in direct output drive the estimates of the secondary impacts which occur in more than 20 other sectors. On Table D-I, the total direct impacts are shown to be almost $47 million. The total direct impacts are comprised of increased Indian agricultural output including $29 million of cotton, $3 million of food grains, $41,000 of tree nuts, $12.2 million for vegetables, and $2.2 million for hay and pasture. The value of $2.2 million for hay and pasture is a net gain value that is obtained after subtracting losses to non-Indians from gains generated on Indian lands. The increases in agricultural output generate over $21.3 million of impacts in other sectors of the three-County economy.

The total effects of $67.9 million of economic activity generate new employment. Table D-II, the Employment Impact Table, shows over 400 new jobs created directly by agricultural production. More than 300 jobs are created indirectly in sectors which serve agriculture in some capacity.

The values on Table D-III, the Indirect Business Taxes Impact Table, are subtracted from the values on Table D-IV, the Total Value Added Impact Table, to estimate income impacts generated by the change in agricultural production. Approximately $29 million in additional income is generated directly by the additional agricultural production. Due to the change in agricultural production, another $11.9 million in income is generated by economic sectors which serve agriculture. The economic impacts for all the alternatives in this Draft EIS are extracted, from IMPLAN results, in the manner described above.

D.V. ADDITIONAL SECONDARY DATA FOR REGIONAL IMPACT ANALYSIS

D.V.a. Pump Cost Projections for Irrigation Water in Central Arizona

Table D-1, Historic Pumping Costs, shows actual pump cost data from 1963 to 1998. The pump cost data for the period 1992 through 1998 appear to be the most consistent data and were selected to be utilized as the base for estimating the future costs of pumping.[5] From 1992 to 1998, the UofA assumed pump lifts to be constant. The average percent change in the data, from 1992 to 1998, was calculated. The average cost over the period, 1994 through 1998, was also calculated for each pumping area. Average costs ranged from $27.11 to $97.42 per af. For each area, across all IDs covered in this study, the values deemed most appropriate to represent future pumping costs are the average costs of pumping for the five-year period, 1994 through 1998. The five-year average cost will be held constant throughout the study period. The pump cost per af per foot of lift was also calculated for each pumping area. Average costs range from just over $0.05 to more than $0.16 per af per foot of lift. The pump cost values provided by Table D-1 are utilized in the analysis of impacts associated with reallocation of CAP water, given the pump lifts assumed in Appendix L and Chapter 3.

D.V.b. CAWCD Pricing and Policy for CAP Agricultural Water

CAWCD non-Indian agricultural water price for 2004, at $35.00, is assumed to be held constant throughout the study period.

On Tables D-2 through D-7, an approximate average blended price for CAP water has been calculated based upon the water supply and pricing of the three CAP water pools. However, the percentage of in-lieu water taken by each ID differs. Therefore, the actual average blended price for water faced by each ID must be calculated individually. After 2004, only Pool One water is assumed to be available, except for limited amounts of Pool Three water during the early years of this analysis. Tables A-3 through A-8 of Appendix A provide annual projected amounts of water available to the NIA sector.

D.V.c. Partial Crop Budgeting and Impacts upon Crop Selection due to Water Cost

This analysis is referred to as partial crop budgeting for two reasons. The first reason is that only total costs and returns are presented for each crop, with essentially no detail regarding the composition of the values. Secondly, as explained below, not all costs of production are taken into consideration; the emphasis is primarily on variable or cash costs. Partial crop budget tables D-8 through D-20 are found at the back of this appendix.

Partial crop budgets were generated for upland cotton, alfalfa hay, and durum wheat. This analysis focuses on upland cotton, alfalfa hay, and durum wheat because these crops are historically the most sensitive to water costs. Such crops may be subject to elimination from a crop rotation as the cost of irrigation water becomes more expensive.

[5] UofA Field Crop Budgets published in 1992, 1993, 1994, 1996, and 1998.

Theoretical economic production assumptions were applied in developing the partial budgets. The first assumption is that farmers will continue to produce a particular crop only as long as the returns from the crop cover all variable costs and contribute something toward fixed costs. For the partial crop budget analysis, the intent is to identify only the variable production costs or only those costs which a farmer, in central Arizona, is assumed to include when making the decision whether to continue to produce a particular crop in the face of declining profitability. The goal of the partial crop budget analysis is to estimate a set of cost and return values that represent a typical farm although it is recognized that each farmer is faced with unique production costs, realized yields, and crop prices. The partial crop budgets provide what is assumed to be the average costs and returns faced by a range of farmers in the various CAP IDs. The outcome provided by the partial budgets is identification of the cost of irrigation water at which farmers, on the average, would decide to terminate production of a particular crop because the returns failed to cover the variable costs of production. If each farmer's production costs and prices were used, on the average, the impacts would be similar to those resulting from this analysis.

UofA 1998 crop enterprise budgets were used as the starting point for the partial crop budget analysis. Average commodity prices and yields over a five-year period, from 1993 to 1997, were provided as the basis for gross revenues. The total cash cost for land preparation and growing expenses including irrigation water costs, and total harvest and post-harvest costs developed by the UofA, were used in this analysis. Costs which were specifically excluded from the analysis include farm pickup use costs for a particular crop, taxes, housing, insurance on farm equipment, capital replacement on machinery and vehicles, interest on equity in machinery and vehicles, property taxes, opportunity interest on land, water assessment, returns to management, and profit.

The values derived are not indicative of the profitability of a particular crop. The values are intended to represent a marginal analysis relative to farmers' growing decisions. For example, the crop profitability decision value for wheat in Pinal County is shown to be $13.68 per acre. The $13.68 represents the revenues above variable expenses that contribute to payment of fixed costs of the farming operation. To the $13.68 is added the current estimated irrigation water cost. Total estimated irrigation water cost plus the profitability decision value is then divided by the af of water applied per acre to calculate the threshold value. The threshold value for wheat in Pinal County is $41.13. The threshold value is the maximum amount a farmer would pay for water to irrigate wheat. In contrast, the 1998 UofA crop enterprise budget for wheat shows a loss of $93.47 per acre when all economic costs are considered. In this study, a farmer is assumed not to consider all economic costs when deciding whether to grow a particular crop. In addition, the economic costs associated with total farm production are unique to each farm operation.

Tables D-8 through D-20 show the partial budgeting results. The estimated maximum average amount a farmer would pay for irrigation water per af is:

Wheat	Pinal County	$41.13
	Maricopa County	$59.77
Cotton	Pinal County	$69.19
	Maricopa	$64.46
Alfalfa Hay	Pinal County	$52.12
	Maricopa County	$43.08

The differences in the wheat estimates between Counties are due mainly to yield differences and required water assumptions. For cotton, the differences in estimates between Counties are also due to yield differences and required water assumptions. In Pinal County, the first crop projected to drop out of production is wheat, followed by alfalfa, and then cotton, given increasing irrigation water costs and assuming that all other variables remained equal. In Maricopa County, forage is projected to drop out of production first followed by grains.

Based upon the estimated incidence of crop elimination in different time periods, the change in total agricultural output is determined. The set of tables D-21 through D-26, Adjustments of Agricultural Output Due to Cropping Pattern Changes – Gross Output, shows estimated changes in total output for each CAP ID, under each alternative, within each time period. The changes in output are aggregated and become the input for IMPLAN which estimates the total economic changes in the economy brought about by changes in agricultural production. The reader should note that the estimated changes in output are due to economic factors that are mostly beyond the impact of CAP reallocation. These changes are included to present a more complete picture of agricultural production in central Arizona. Tables D-21 to D-26 are found at the back of this appendix, and are summarized in Table D-27.

D.VI. EXISTING CONDITIONS

Existing conditions for water availability, cost, and demand are assumed to be identical to conditions under the No Action Alternative for 2001.

D.VI.a. Total Water Availability and Cost

The availability and price of CAP excess water for non-Indian agricultural use in 2001 is shown below. After CAP IDs have utilized their apportionment, set by CAWCD, of CAP agricultural

water in Pools One and Two, they may purchase AWBA in-lieu water. No restrictions are placed on purchases of water from Pool Three. In 2001, the CAP Indian use water will cost $58.00 per af. The amount of water available to Indians is 453,224 af.

CAP Excess Water Pools and Pricing – Existing Conditions

	Quantity (af)	Price ($)	Average Price ($)
Pool One	200,000	34.00	
Pool Two	200,000	24.00	
Pool Three	129,989	33.00	
AWBA In Lieu	124,520	21.00	
Total Water	654,509		24.28

Groundwater pumping costs vary greatly even within IDs due to varying depths to the water table and the type, source, and cost of energy for pumping. Pumping costs per af are assumed to remain constant throughout the study period for all alternatives. Energy for pumping is electric except as noted.

Projected Cost of Pumping Irrigation Water in Central Arizona[6]

	Price ($)
Pinal County	
Coolidge Area	30.40
Casa Grande Area	42.04
Eloy Area	42.08
Stanfield Area	34.62
Maricopa Area	27.11
Maricopa County	
Harquahala Valley Area (natural gas)	57.91
Queen Creek Area (natural gas)	60.73
Tonopah Area	57.91
New Magma Area	60.73

[6] Areas are as identified by the UofA in the annual crop budget publications.

D.VI.b. Total Water Demand

Below is a compilation of total water demand in af by all CAP IDs for 2001. Total CAP water available is 606,000 af.

Derivation of Water Demand for all CAP IDs (af)

	Total Water Utilization	CAP Water Demand	Groundwater Demand
Districts			
MSIDD	247,994	186,580	64,414
CAIDD	218,892	191,064	27,818
HIDD	84,447	70,005	14,442
NMIDD	86,583	86,583	0
QCIDD	84,447	52,321	32,126
HVIDD	98,264	34,499	63,765
TIDD	14,046	10,991	3,055

Indian water demand for CAP water in 2001 is 73,500 af. The Ak-Chin Indian Community has been utilizing its CAP water for agriculture since 1987. The additional 8,500 af supply of water is projected to be used by the TON. The Schuk Toak District is projected to use 7,500 af for cotton cultivation, and the San Xavier District is projected to use 1,000 af for forage production. This information is provided on Tables D-28 through D-33, Indian Agricultural Development and Production – 2001 through 2050, which may be found at the back of this appendix.

D.VI.c. Crop Patterns, Yields, and Prices

Yield per acre and prices are assumed to be constant throughout the study period for all alternatives. Crop patterns for 2001 are presented below.

Acreage 2001

	Cotton	Grains	Forage	Vegetables	Trees
MSIDD	27,862	18,154	8,711	3,106	3,886
CAIDD	28,546	22,823	2,957	3,116	2,281
HIDD	12,817	8,627	3,632	632	0
NMIDD	9,042	5,107	5,449	1,808	1,855
QCIDD	5,258	3,847	2,632	2,632	368
HVIDD	13,419	3,109	3,709	3,709	505
TIDD	2,463	22	546	0	0
GRIC	0	0	0	0	0
Schuk Toak	1,125	0	0	0	0
Chuichu	0	0	0	0	0
San Xavier	0	0	200	0	0

	Yield (per acre)[7]		
	Pinal	Maricopa	Price ($)
Cotton (lbs. lint)	1,154	1,227	$ 0.678
Wheat (lbs.)	4,900	5,600	$ 0.753
Alfalfa Hay (tons)	7.5	8.0	$ 96.70

Vegetables and trees are used to the extent these crops come into agricultural production on Indian lands during the study period. Vegetable and tree production on non-Indian lands in the CAP IDs is assumed to continue throughout the study period regardless of the price of water. Output for vegetables and tree crops in the NIA sector is not examined since the amount of acreage in these crops is assumed to be unchanged throughout the study period. Pinal County prices and yields were used for TON agriculture because TON acreage is relatively small.

D.VI.d. Economic Snapshot at the County Level

Table D-34 shows industrial sectors, industry output, employment, and total value added broken down into employee compensation, proprietary income (owners' income), and other property income (capital income) and indirect business taxes for the three-County area. At the beginning of the study period, all agricultural output accounts for about 1.1 percent of the total industrial output of the three-County area. In the three-County economy, manufacturing, services, and FIRE are the big producers accounting for 21.4 percent, 20.75 percent, and 17.83 percent of the total output respectively. Agricultural employment and employee compensation account for 1.6 percent, and of the total number of jobs, 0.7 percent of the total employee compensation in the three-County economy. The services sector is the largest employer with 32.78 percent of the jobs and 26.75 percent of the employee compensation in the three-County area. The services sector is also the biggest contributor, attributing about 43.32 percent to proprietary income in the three-County area. Proprietary income consists of payments received by self-employed individuals as income. The trade and FIRE sectors are the largest contributors to indirect business taxes of about 41.97 and 35.35 percent respectively.

Table D-35 shows the same information as Table D-34 but for Pinal County. In Pinal County, total agricultural output accounts for 13.3 percent of total industrial output, 7.5 percent of total employment, and 3.56 percent of total employee compensation. Agriculture contributes the greatest share, 42.1 percent, of proprietary income in Pinal County. Approximately 8.2 percent of all indirect business taxes are collected on agricultural output. Of all the industrial sectors in Pinal County, mining is the most significant in terms of output. Mining contributes about 28.22 percent of all industrial output in Pinal County. Government and services are the biggest employers contributing 24.71 percent and 23.6 percent of the total jobs in Pinal County respectively. Government provides the largest percentage of employee compensation in Pinal County, about 28.88 percent. From a tax perspective, trade contributes a large share of indirect business taxes in Pinal County, amounting to about 29.3 percent.

[7] Yields for Pima County are not used since none of the CAP IDs are located in Pima County.

D.VII. CONDITIONS ASSOCIATED WITH WATER AVAILABILITY, DEMAND, AND PRICE – ALL ALTERNATIVES

D.VII.a. Total Water Availability, Demand and Cost

In Tables D-2 through D-7, Projections of CAWCD Excess Water Pools and Pricing – 2001 through 2051, estimated water prices and quantities for each alternative are shown for Pools One, Two, and Three and AWBA in-lieu water. The water supplies reflected in this table are for use by CAP IDs. The total water available in each year varies from year-to-year and is derived by summing across the water quantity columns under Pools One, Two, Three and AWBA in-lieu. The price of water listed to the far right-hand side of the table is derived by averaging the water prices estimated for each source of water in each year weighted by the associated annual water supply for each source of water. Among the categories of water, the availability, price, and duration of supply vary over the study period. Although use of AWBA and other in-lieu water is restricted, it is available in each alternative up to certain maximum amounts for $21.00 per af from 2001 through 2017.

In summary, the supply of CAWCD excess water for NIA under each alternative is:

Alternative	CAWCD Excess Water 2001 – 2050 (af)
Settlement	14,543,977
No Action	13,176,193
Alternative 1	13,164,356
Alternative 2	12,258,221
Alternative 3A	13,671,231
Alternative 3B	10,966,861

The Settlement Alternative offers the maximum annual amount of Pool One water (400,000 af) for the longer period of time (2004 – 2018) compared to 2004 – 2010, for Alternatives 1, 2, and the No Action Alternative, and 2004 – 2008, for Alternatives 3a and 3b. Pool Two water and AWBA in-lieu water supplies are the same for all alternatives. Pool Three water supplies vary as reflected on Tables D-2 through D-7. Water costs also vary as reflected on the tables.
Indian agricultural water varies under each alternative and is reflected below:

Alternative	Water Supply (af)
Settlement	16,421,616
No Action	14,374,216
Alternative 1	15,866,415
Alternative 2	17,824,740
Alternative 3A	18,788,259
Alternative 3B	18,788,259

In Tables D-36 through D-77, District Analysis and Summary 2001 through 2051, in back of this appendix, demand for CAP water and pumped groundwater and total water utilization are

provided for each CAP ID for all alternatives throughout the study period. Table D-27 summarizes the crop acreage data from these tables.

Each CAP ID has two sources of water: the CAP and pumped groundwater. The proportion of use of each water source by individual districts varies based upon cost and availability of CAP supplies. CAP IDs are assumed to purchase the entire supply of CAP water available, as long as the price of CAP water is commensurate with groundwater pumping costs. Under the various alternatives in this Draft EIS, the availability of CAP water varies. Also, each district is assumed to have a quantified allocation set by CAWCD.

Groundwater pumping is effectively unrestricted. Although an upper limit exists on the amount of groundwater that can be pumped for individual lands, the limit is ineffective as long as the total water supply applied for irrigation includes excess CAP water.

Tables D-78 through D-83, Water Cost Function Frontier Groundwater Pumping and CAP Water Costs - IDs, in back of this appendix, provide the costs of CAP and pumped groundwater and the blended costs of the two water supplies under each alternative at six points in time during the study period. The blended or average price of irrigation water estimated to be faced by each ID becomes the value that is compared with farmers' ability to pay derived from the partial crop budgets. If the cost frontier value exceeds the farmers' ability to pay value in the partial crop budgets, then production of a particular crop is assumed to be terminated by all of the farmers in a CAP ID. If the analytical model results in particular crops going out of production through time, then total water demand by a particular district will decrease. The decrease in demand naturally follows because of the assumption that elimination of a particular crop from the production regime results in additional land being fallowed.

The blended average irrigation water costs are provided in a series of six tables with an indication of when certain crops are projected to drop out of production. Elimination of specific crops from production reduces the demand for irrigation water. The reduced demand causes the average cost of irrigation water to change. In some instances, the price changes may affect the timing of elimination of a crop from production. Thus, a problem of circular reference emerges. Circular reference is resolved by allowing only one additional iteration of crop elimination, decreasing water demand, and price changes. In this study, one additional iteration was found to capture the major changes in crop acreage and water price. Subsequent iterations may affect the incidence of land fallowing within a time period, but subsequent iterations do not move the incidence of land fallowing from one time period to another. For example, under the Settlement Alternative, grain production in CAIDD is projected to cease by 2043. Iterations for adjustments may cause changes in elimination of grain production to occur anytime in between 2030 and 2043. However, for the purposes of this study, evidence that grain production may terminate by 2043 is sufficient.

The Water Cost Function Frontier tables show that under all alternatives, grain and forage crops go out of production in the districts which have the highest costs of pumping groundwater. As CAP water supplies decrease during the study period, IDs rely more heavily on groundwater. Under all alternatives in this Draft EIS, districts such as CAIDD, NMIDD, QCIDD, HVIDD, and TIDD that have pumping costs ranging from about $42.00 to $61.00, cannot cover variable costs of grain and/or forage production. All alternatives are similar in that CAIDD, NMIDD,

QCIDD, HVIDD, and TIDD are projected to experience a loss in crop acreage and output because of water costs. The only difference among the alternatives is that the timing for some of the crops to drop out of production changes slightly by one time period. Under the Settlement Alternative, cotton is also projected to go out of production in QCIDD in 2051. Grain production is projected to end in HIDD in 2051, under all alternatives. Across all alternatives, no crops are projected to go out of production in SCIDD, MSIDD, and RID during the study period due to water costs. These districts have pump costs that are estimated to range from $27.00 to just more than $36.00 per af.

Table D-27, Composite District Analysis and Summary and Adjustments of Agricultural Output Due to Cropping Changes, reflects the acres in production and lost crop acres over the entire study period in each of the alternatives for the CAP IDs. In terms of lost crop acreage, the outcomes of the reallocation strategies in each of the alternatives are similar. District analysis and summary tables for each individual district, Tables D-36 to D-77, are found in back of this appendix.

Tables D-28 through D-33, Indian Agricultural Development and Production – 2001 through 2051, show the crops produced and estimated gross sales per acre on lands farmed by the GRIC and the Schuk Toak, Chuichu, and San Xavier Districts of the TON.

During the study period, it is assumed Indian lands will be developed resulting in increases in total agricultural production in the three-County area. Current Indian agricultural production is assumed to be unaffected by any reallocation of water. For this study, the following Indian agricultural production is assumed to occur with some variation among the action alternatives.

Newly developed acreage of the Schuk Toak and the San Xavier Districts of the TON is projected to range from a total of 9,600 acres under the No Action Alternative and Alternative 1 to 13,600 acres under the Settlement Alternative and Alternatives 2, 3a, and 3b in 2050. Newly developed GRIC acreage is projected to peak under Alternative 3 at 136,882 acres in 2050. Under the other alternatives, GRIC acreage varies from 85,801 acres under No Action to 118,000 acres under the Settlement Alternative by 2050. The least amount of new Indian agricultural acreage is developed under Non-Settlement Alternative 1 because of the smaller allocation of CAP water to the Indian sector relative to the other action alternatives.

Agricultural output from the new Indian developments represents positive economic gains or impacts which are multiplied throughout the entire economy of the three-County area. The gains from Indian agriculture offset portions of losses or negative economic impacts associated with non-Indian lands going out of production due to economic forces under the various reallocation alternatives. The itemization and summary of economic impacts are shown on Adjustments of Agricultural Output Due to Cropping Pattern Changes, Tables D-21 through D-26, at the back of this appendix.

D.VIII. CROP ACREAGE AND OUTPUT

D.VIII.a. All Alternatives

Table D-27, Composite District Analysis and Summary and Adjustments of Agricultural Output Due to Cropping Changes, provides a composite of all non-Indian acreage and output for each alternative. Analysis and Summary tables for each district are located in Tables D-36 to D-77. Tables D-28 through D-33, Indian Agricultural Development and Production – 2001-2051, provide data for acres in production and sales for cotton, grain, forage, vegetables, and tree crops for the GRIC and TON.

On Table D-27, cotton acreage and sales remain constant throughout the study period for all alternatives, except cotton acreage is projected to decrease in QCID by 2051, under the Settlement Alternative. Vegetable and tree acreage remains constant throughout the study period for all alternatives. Among the alternatives, differences are reflected on Table D-27 in the timing of acreage / sales declines in grain and forage cultivation.

Tables D-28 to D-33, Indian Agricultural Development and Production 2001 – 2051, allow for comparison of acreage and sales of cotton, grains, forage, vegetables, and tree crops under all alternatives for Indian agriculture during the study period. Tables D-21 through D-26, Adjustments of Agricultural Output Due to Cropping Pattern Changes, show the net change in agricultural output in dollars under each alternative throughout the study period. These tables also show the magnitude, incidence, and timing of losses and gains in agricultural output per crop for each ID and TON and GRIC. Losses in output are attributed to the non-Indian IDs, and the gains in output are attributed to the GRIC and TON, indicating a shift in some production from the non-Indian to Indian agricultural sector. However, for most indicator years under all alternatives, the net changes in output are largely positive, signifying that more Indian land is coming into production than is going out of production in the NIA IDs. Therefore, in the three-County economy and the Pinal County economy, economic activity in agriculture is projected to increase overall. The increased economic activity stimulates increases in employment and income in the agricultural sector and other impacted sectors in the three-County economy and in Pinal County. The increased employment and income are not isolated to GRIC and TON but spill over into the surrounding community.

Changes in agricultural output, derived as discussed above, are input into the IMPLAN model which estimates the impact of such changes upon the three-County economy and the Pinal County economy. The reader should understand that the changes in output estimated for each indicator year in each alternative are not due solely to changes in water allocations. The projected changes are also a result of projected economic activity and various economic forces. The true impact of the change in water allocation is evident in the comparisons among the alternatives for corresponding years. These comparisons among alternatives are made on the set of tables titled, “Comparison of Agricultural Outputs,” which compare the outputs under each alternative for the indicator years. These tables are discussed below.

D.VIII.b. Settlement Alternative

During the study period, as water costs increase, 40,404 acres of grain, 11,166 acres of forage, and 5,258 acres of cotton are projected to drop out of production in the CAP IDs as shown on Table D-27. Grain acreage is projected to decrease from 61,689 acres in 2001 to 21,285 acres in 2050. Overall forage response to reallocation of CAP water is the same for all alternatives, but production levels do vary during intervening indicator years. Forage acres decrease throughout the study period from over 26,000 acres in 2001 to about 15,000 acres in 2050. Under the Settlement Alternative, cotton acreage is projected to decrease slightly between 2043 and 2050. In all the alternatives, vegetable and tree crop acres do not change in the CAP IDs. Acreage is estimated to remain steady at 15,003 acres for vegetables and 8,895 acres for trees.

During the study period, the GRIC and the TON will bring additional lands into agricultural production. In 2001, an estimated 1,325 acres come into production for cotton and forage on the Schuk Toak and San Xavier farms. By 2004, the TON has 2,420 acres of additional land in cultivation for cotton, grains, and forage. In 2017, 52,000 additional acres are cultivated by GRIC in cotton, grains, forage, and vegetables. The TON increases the number of additional acres in cultivation to 9,600 acres, including cotton, grains, forage, vegetables, and tree crops. In 2030, the TON is cultivating an additional 4,000 acres. No additional TON acreage is projected to be brought under cultivation after 2030. The GRIC continues to develop additional acreage up to 2030. In 2030, the GRIC's newly developed acreage is 118,000 acres including cotton, grains, forage, and vegetables. No more additional acreage dependent on CAP water is projected to be developed by GRIC between 2030 and 2050. Cotton is the primary crop on these additional GRIC acres, and it is estimated to cover 66,563 acres.

Tables D-21 through D-26, Adjustments of Agricultural Output due to Cropping Pattern Changes, show the total changes in output for each ID, the TON and GRIC. In the analysis of the Settlement Alternative, the change in agricultural output in 2001 is $1,185,065 for the three-County area due to increases in production on San Xavier and Schuk Toak lands. No impacts occur in Pinal County alone. In 2004, the three-County economy would realize a net loss in agricultural output estimated to be $2,533,249. A net loss is projected to occur because non-Indian agriculture in Maricopa County would lose about $4.4 million in agricultural output. Indian agricultural development, still in the early stages, generates only about $1.9 million in agricultural output. In 2004, the agricultural output in Pinal County economy still appears to be unchanged.

In 2017, for the Settlement Alternative, the GRIC is projected to produce $47,298,775 of agricultural output. Agricultural output in NMIDD is projected to decrease by $1,876,823. Total agricultural output in the Pinal County economy for the commodities and producers included in this study is $46,818,368. Total change in output in the three-County economy is $46,543,817. The total change in output for Pinal County is slightly greater than the change in output for the three-County area because of the value of GRIC production, $47 million, in Pinal County and the loss of $7.9 million of grain and forage sales in three IDs in Maricopa County. A pattern of overall net gains is evident for 2030, 2043, and 2050. By the end of the study period, the estimated net positive impacts for Pinal County are projected to be $91,843,373. The total for the three-County area is projected to be $89,206,724. In Pinal County, the losses in output to NIA are estimated to be $17,563,678, and the gains in Indian agricultural output are

estimated to be $109,407,051. For the three-County area, the estimated loss in NIA output of $28,734,949 is offset by the gains in Indian agricultural output of $117,941,673.

D.VIII.b.1. County-Level Economic Impacts – Settlement Alternative

Under the Settlement Alternative, NIA would receive substantial debt relief on its debt owed to the United States for construction of CAP distribution systems. In addition, non-Indian farmers would receive relief from RRA which limits the benefits of CAP water to individual farmers and incurs administrative costs for IDs. Additional irrigated land would be eligible to receive CAP water. In MSIDD and CAIDD, commingling fees would be eliminated for delivery of non-Project water through CAP distribution systems.

Indian agricultural water use increases as non-Indian agricultural water use decreases. In Pinal County, total agricultural production is projected to increase because of the GRIC lands coming into agricultural production. In Pinal County, the pattern of spending on factors of agricultural production (e.g., fertilizer, machinery, farm equipment, and chemicals) is projected to be essentially unchanged. The three-County model shows agricultural output increases as well.

The construction of the Indian agricultural water distribution systems, from 2001-2015, is expected to provide jobs to central Arizona as well as in the GRIC and TON. Given the high unemployment rate in the GRIC and TON, these new jobs would be a benefit. The projected build out for CAP Indian distribution systems under all alternatives is as follows:

Projected GRIC and SAWRSA Construction Expenditures (Units / $1,000)

	Projected Construction Expenditures	
Year	GRIC	SAWRSA
2001	$22,600	$ 6,800
2002	$36,800	$ 8,427
2003	$36,800	$14,085
2004	$36,800	$ 9,759
2005	$36,800	$ 3,332
2006	$36,800	$ 1,152
2007	$36,700	
2008	$29,400	
2009	$26,700	
2010	$24,900	
Total	$324,300	$43,555

Under the Settlement Alternative, the GRIC would receive an additional $200 million in annual increments of $25 million, from 2001 to 2008, for agricultural development in the GRIC. The additional $200 million is not reflected in the schedule above.

Construction of the distribution systems on the TON and the GRIC is expected to have positive economic impacts to the surrounding three-County area. The Federal construction expenditures would impact the entire three-County area off of Reservation lands because most of the services necessary to carry out the construction of the works, such as agricultural engineering and design, are not available on Reservation and must be obtained from the general

economy. Although the Settlement Alternative would stimulate greater economic activity in the three-County area due to the additional outlays than the other alternatives, central and southern Arizona would benefit economically whether or not a settlement is finalized. Construction of Indian distribution systems would occur even in the absence of a settlement.

Table D-84, Impacts on Output, Employment, and Income of Construction of Indian Distribution Systems – Anticipated Federal Outlays, reflects the impact of Federal construction expenditures for Indian distribution systems in 2001 and 2004. Federal construction expenditures are expected to occur from 2001 through 2012. The expenditures in 2001 and 2004, and the associated impacts, are analyzed because those years are the two indicator years over which the Federal expenditures are expected to occur. However, construction, employment, and income impacts over a 10-year period were also estimated on Table D-84. For impacts under the Settlement Alternative, Table D-84 includes the additional $200 million to the GRIC.

On Table D-84, under Construction Expenditures Impacts (dollars per year), the columns labeled "Direct" reflect the actual expected amount of Federal expenditures to be made in 2001 and 2004, under the various alternatives. The column labeled "Total" reflects the direct, indirect, and induced effects from the Federal spending in the three-County area. The "Comparison of Settlement with No Action Alternative" column reflects the difference in Federal expenditures and associated impacts in central and southern Arizona between the Settlement Alternative and the No Action Alternative. The additional $25 million outlay in 2001 and 2004 is estimated to result in positive economic impacts in the three-County area of more than $40 million dollars in each of the indicator years.

The employment impacts from the Federal outlays, although temporary, are large. In 2001, under the Settlement Alternative, an estimated 475 jobs would be created in the construction sector alone. In addition, 429 more jobs (914 total jobs) are projected to be created to support the demand by the construction sector to complete the distribution systems. In 2004, the number of jobs created in the construction sector is projected to be 625 with an additional 578 jobs (1,203 total) projected to support demand by the construction sector. Comparison of the Settlement Alternative with the No Action Alternative in 2001 and 2004 shows that, in total, over 400 more jobs are projected to be created under the Settlement Alternative due to the additional $25 million of Federal funding in 2001 and 2004. Over a 10-year period, about 3,300 more person-years of employment are projected to be generated under the Settlement Alternative than under the No Action Alternative.

Positive impacts to income are projected for the three-County area due to the increased employment in the construction sectors and in sectors which provide services and materials to the construction sector. Under the Settlement Alternative in 2001 and 2004, income in the construction sector is estimated to increase over $19 million and $25 million respectively. Total income is estimated to increase in excess of $37 million in 2001 and almost $49 million in 2004. Compared to the No Action Alternative, the Settlement Alternative is projected to stimulate a total of $17 million more income in 2001 and 2004. Over a 10-year period, income impacts are well over $100 million under all alternatives and exceed just over $400 million under the Settlement Alternative.

Tables summarizing and comparing the impacts of changes in agricultural output and consequently in employment and income have been made to briefly show the total impact over the study period in the three-County and Pinal County economies. The summary and comparison of impact tables are based on output data developed in Tables D-21 through D-26, Adjustments of Agricultural Output due to Cropping Pattern Changes-Gross Output. The summary and comparison tables exclude the Federal expenditures made for construction of Indian distribution systems. The impacts to the three-County area associated with the Federal outlays are in addition to the impacts due to changes in agricultural output.

Table D-85, Summary of Impacts of Agricultural Output Changes – Settlement Alternative, shows that the total net direct and secondary impacts to the three-County area and Pinal County are positive in all the indicator years except 2004. The "Total Impacts" column represents the net change in the dollar value of agricultural output from Table D-21, Adjustments in Agricultural Output due to Cropping Pattern Changes – Settlement Alternative. The "Total Impacts" column is also the sum of the Non-Indian and Indian Impacts columns on Table D-85. "Total Secondary Impacts" are the sum of the indirect and induced effects caused by changes in agricultural activity in the three-County area and Pinal County generated by IMPLAN. As a general indicator of the magnitude of the total impacts of CAP water reallocation over the study period, an estimated summary is given for the entire 50-year period of the analysis. The 50-year indicators are derived by assuming that the value of the impacts reflected for each indicator year occurs annually during the intervening years. Table D-85 shows that in 2004, the three-County economy is projected to experience a loss because the loss in NIA is larger than the growth in Indian agriculture. However, in all the other indicator years, the total direct impacts are positive. The 50-year total direct impact estimate is about $4 billion.

For Pinal County, Table D-85 shows that no change in agricultural output is projected, in 2001 and 2004, associated with a reallocation of CAP water under the Settlement Alternative. Total direct and secondary impacts are positive for indicator years 2017 through 2050, because gains in Indian agriculture are projected to be greater than losses in NIA. Total direct impacts over the 50-year period in Pinal County are projected to be more than $3.9 billion.

A set of tables titled, "Comparison of Impacts of Agricultural Output Changes," summarizes comparisons between each action alternative and the No Action Alternative. The estimated impact of any action alternative can only be understood by comparing that alternative with the No Action Alternative. Such comparisons provide reasonable estimates of economic impacts resulting from the reallocation of CAP water. Table D-87, Comparison of Impacts of Agricultural Output Changes – Settlement Versus No Action, shows that, in the three-County area, changes in agricultural output under the Settlement and No Action Alternatives are projected to be identical in 2001. In 2004 and 2017, estimated total direct and secondary impacts (losses) to the three-County area were greater under the Settlement Alternative than under the No Action Alternative. In indicator years 2030 through 2050, estimated gains in total direct impacts and secondary impacts in the three-County area are greater under the Settlement Alternative than the No Action Alternative. Over the 50-year period, total direct impacts are projected to be more than $770 million under the Settlement Alternative than the No Action Alternative. Total secondary impacts under the Settlement Alternative are projected to exceed total secondary impacts under No Action by more than $367 million over the 50-year period.

However, Table D-86 also shows that losses in the NIA sector are consistently projected to be greater under the Settlement Alternative than under the No Action Alternative. Under the Settlement Alternative, total 50-year NIA losses are projected to be about $363 million greater than under the No Action Alternative. Thus, although under the Settlement Alternative the three-County area overall is projected to experience a larger expansion in agricultural production than under the No Action Alternative, the NIA sector experiences greater losses under the Settlement Alternative as compared to the No Action Alternative.

For Pinal County overall, Table D-86 shows greater gains in estimated total direct and secondary impacts under the Settlement Alternative over the 50-year period than under the No Action Alternative. For example, total direct impacts are projected to be about $853 million greater under the Settlement Alternative than under the No Action Alternative. Total secondary impacts under Settlement are projected to exceed total secondary impacts under No Action by about $377 million. However, NIA in Pinal County appears to experience greater losses under the Settlement Alternative than under No Action. Estimated losses in NIA under Settlement exceeds losses to NIA under No Action by about $185 million over the 50-year period.

Table D-87, Summary of Employment Impacts – Settlement Alternative, shows the number of jobs directly created in the agricultural sector and in sectors that support production agriculture. These jobs are created by the net gains in agricultural output in the three-County area and Pinal County. The employment data include full-time, part-time, permanent, and seasonal jobs. By the end of the study period, an estimated 60,000 person-years of employment are projected to be created in the three-County economy. The only indicator year that shows a loss in jobs associated with agriculture is 2004. This result is consistent with Table D-85, Summary of Impacts of Agricultural Output Changes – Settlement Alternative, which projected a net loss in agricultural production in the three-County area in 2004.

In Pinal County, neither job creation nor job loss is projected to occur until after 2004. This result is consistent with Table D-85 which shows no changes in agricultural output in Pinal County until 2017. Gains in agricultural production under the Settlement Alternative are projected to generate about 58,000 person-years of employment over the 50-year period.

Table D-88, Comparison of Employment Impacts – Settlement Versus No Action, compares the Settlement and No Action Alternatives in terms of the number of jobs created. For the three-County area and Pinal County, the Settlement Alternative is projected to create more jobs than the No Action Alternative over the 50-year period. In Pinal County, between 2001 and 2017, differences in employment impacts between the Settlement and No Action Alternatives are not apparent because agricultural output changed little in Pinal County from 2001 to 2017 under both alternatives. Interestingly, over the 50-year period, Pinal County total employment impacts under the Settlement Alternative compare more favorably to the No Action Alternative than the three-County employment impacts. This result occurs because Pinal County is not projected to experience the net losses in agricultural output and consequent losses in jobs that the three-County area is projected to experience in 2004.

Table D-89, Summary of Income Impacts – Settlement Alternative, shows the total direct and secondary income estimated to be generated under the Settlement Alternative due to changes in

agricultural output. For the three-County area, a loss of income is projected for 2004. Total loss in income is about $2.4 million. This result is consistent with Table D-85 which shows a net loss in agricultural output for the three-County area in 2004. However, from 2017 on, the three-County area is projected to experience gains in income due to expansion of agricultural production. Overall the estimated total income impacts show a net gain of approximately $3.5 billion. In Pinal County, no impacts to income are projected to occur until 2017, because no changes in agricultural production are projected for the early part of the study period under the Settlement Alternative. All net income impacts are positive in Pinal County because of the large increase in agricultural production by the GRIC. By the end of the study period, total impacts to income in Pinal County are projected to be about $2.4 billion.

In Table D-90, Comparison of Income Impacts – Settlement Versus No Action, the Settlement Alternative is projected to provide higher gains in total income compared to the No Action Alternative. Compared to the No Action Alternative, the Settlement Alternative is projected to stimulate about $675 million more in income than the No Action Alternative. However, in the three-County area the Settlement Alternative lags behind the No Action Alternative in terms of income in 2004 and 2017. In Pinal County, the two alternatives show no apparent differences in income until after 2017, because agricultural production is projected to be unchanged in the early part of the study period under the Settlement Alternative. Projected income is higher under the Settlement Alternative because more lands are projected to be under cultivation under the Settlement Alternative than under the No Action Alternative. Total income impacts under the Settlement Alternative exceed total income impacts under No Action by about $530 million.

D.VIII.c. No Action Alternative

Table D-27, Composite District Analysis and Summary and Adjustments of Agricultural Output Due to Cropping Changes, shows that NIA grain acreage and sales are not projected to decrease until 2043. Forage is projected to decline steadily between 2001 and 2017. However, in 2030, NIA forage acreage increases since 3,154 acres of forage are projected to come back into production in QCID after going out of production in 2017. QCID forage is the only instance where a crop production resumes. Between 2017 and 2030, water costs facing QCID farmers are projected to decrease, thus forage cultivation is feasible (see Table D-79, Water Cost Function Frontier – Groundwater Pumping Versus CAP Water Costs – No Action). QCID water costs are projected to decrease because groundwater demand is projected to decrease significantly due to cropping changes. Output levels in cotton, vegetables, and tree crops are projected to remain constant throughout the study period.

Table D-29, Indian Agricultural Development and Production – 2001 through 2050, No Action, shows that total new TON agricultural development is 9,600 acres in cotton, grain, vegetables, forage, and tree crops. Cotton is the predominant crop. Full development of the new acreage is projected to be completed by 2017. No new GRIC production is projected to occur until 2017. In 2017, the GRIC is projected to be cultivating cotton, grains, forage, and vegetables on 52,000 acres. By 2030, new GRIC acreage equal to 85,801 acres is projected to be under cultivation. No more additional acreage is projected to be under cultivation by the end of the study period. Total additional TON and GRIC agricultural acreage is estimated to be 95,401 acres.

D.VIII.c.1. County-Level Economic Impacts – No Action Alternative

Table D-91, Summary of Impacts of Agricultural Output Changes – No Action Alternative, shows that net total direct impacts over the 50-year period for the three-County area are projected to be about $3.2 billion. Losses to NIA are projected to be about $409 million over the study period. The estimated value of Indian agriculture is about $3.6 billion, and secondary impacts are estimated to be about $1.5 billion. Pinal County shows no impacts due to changes in output until 2017. The loss to Pinal County NIA is about $250 million. Net total direct impacts are positive, about $3.1 billion, because the value of Indian agricultural output is estimated to be about $3.4 billion. Impacts to sectors supporting production agriculture are positive at about $1.3 billion.

Table D-92, Summary of Employment Impacts – No Action Alternative, shows that over the study period, about 51,000 person-years of employment would be created under the No Action Alternative due to changes in agricultural production. The employment impact data in 2004 look peculiar with negative direct impacts and total impacts and positive secondary impacts. The agricultural data and IMPLAN output have been examined and no errors were discovered. In 2004, projected NIA losses, $1.6 million, and Indian gains, $1.9 million, are close, resulting in net gains of $329,071. Total secondary output impacts are $312,379. Employment impacts of such relatively small changes are difficult to estimate in IMPLAN. Secondary employment impacts are probably too small to measure accurately. Pinal County shows job growth from 2017 to the end of the study period. Over the 50-year period, about 47,000 person-years of employment are projected to be created. Much of this job growth would be attributed to the increase in GRIC production in Pinal County.

Table D-93, Summary of Income Impacts – No Action Alternative, shows the change in income over the study period in the three-County area and Pinal County. In the three-County area, income impacts are relatively low in 2001 and 2004 because little change in agricultural output is projected to occur. No losses in income are projected to occur under the No Action Alternative. Total income impacts in the three-County area are projected to be about $2.8 billion. Pinal County appears to have no projected impacts to income before 2017 because minimal change in agricultural production is projected for that period. From 2017 until the end of the study period, the total impacts to income are positive and are estimated to be about $1.9 billion.

D.VIII.d. Alternative 1

Table D-27, Composite District Analysis and Summary and Adjustments of Agricultural Output Due to Cropping Changes, reflects that in NIA, grain acreage is projected to decline from 61,689 acres to 25,132 acres over the 50-year period. Forage acreage is projected to decline from 26,466 acres to 15,300 acres over the same period.

Table D-30, Indian Agricultural Development and Production – 2001 through 2050, Alternative 1, shows that total additional TON development is 9,600 acres. TON acreage is projected to be fully developed by 2017. The predominant crops are grains, forage, and cotton, but vegetables and tree crops are also projected to be cultivated by the TON. No new production is projected on GRIC lands until 2017. By 2017, the GRIC is projected to have 52,000 additional lands under

cultivation. Cotton and grain are projected to be the predominant GRIC crops. Additional GRIC acreage is projected to peak by 2030 at 93,712 acres. Total Indian agricultural acreage is estimated to be 103,312 acres.

D.VIII.d.1. Economic Impacts at the County Level – Alternative 1

Table D-94, Summary of Impacts of Agricultural Output Changes – Alternative 1, shows that total direct and secondary output impacts are positive for all indicator years throughout the study period in the three-County area. The total direct impacts associated with agricultural output over the 50-year period are projected to be $3.4 billion. Total secondary impacts over the 50-year period are projected to be about $1.5 billion. Losses to NIA are about $560 million. Indian impacts are approximately $3.9 billion. In Pinal County, in 2001 and 2004, income impacts cannot be measured because changes in agricultural output in those years are projected to be minimal. Total direct and secondary impacts over the study period are positive for every indicator year. Over the 50-year period, total direct impacts are projected to be about $3.2 billion. Total secondary impacts are estimated to be $1.4 billion. NIA losses are projected to be just over $376 million. Indian impacts are projected to be $3.6 billion.

Table D-95, Comparison of Impacts of Agricultural Output Changes – Alternative 1 versus No Action, shows no differences in output impacts between Alternative 1 and No Action in the three-County area and Pinal County in 2001 and 2004. Overall, agricultural output is projected to be higher under Alternative 1 compared to No Action, except for total direct impacts in 2043 in the three-County area and total direct impacts in Pinal County in 2017. Over the 50-year period, estimated total direct impacts of agricultural output changes in Alternative 1 exceed the No Action Alternative by about $116 million. Estimated total secondary impacts in Alternative 1 exceed total secondary impacts in the No Action Alternative by about $67 million. Pinal County also exhibits higher projected agricultural output compared to the No Action Alternative. Estimated total direct impacts in Alternative 1 exceed total direct impacts in the No Action Alternative by about $140 million. Under Alternative 1, estimated total secondary impacts exceed total secondary impacts under No Action by about $79 million.

Table D-96, Summary of Employment Impacts – Alternative 1, reflects the estimated impacts to employment due to changes in agricultural output over the study period. Overall, in the three-County area, approximately 50,000 person-years of employment are projected to be created over the 50-year period. The employment impacts in 2004 are identical to those in the No Action Alternative for the same year. Employment impacts appear to be too small to be properly estimated. Net change in agricultural output, in 2004, is about $329,000. Estimated total employment impacts for Pinal County show that about 48,000 person-years of employment would be created over the 50-year period due to agricultural production.

Table D-97, Comparison of Employment Impacts – Alternative One Versus No Action, reflects no difference between employment impacts between the two alternatives in 2001 and 2004. Over the 50-year period, agricultural production is projected to create slightly more jobs under the No Action Alternative than under Alternative 1 in the three-County area. The employment impacts in the three-County area under the two alternatives are close in magnitude because the change in agricultural output under each alternative is similar. In Pinal County in the early years of the study period, little change in agricultural output is projected to occur under No

Action and Alternative 1. No employment impacts are projected for either alternative in the early years. Like the three-County model, estimated employment impacts in Pinal County under Alternative 1 are similar to those under the No Action Alternative.

Table D-98, Summary of Income Impacts – Alternative 1, reflects income gains due to changes in agricultural output in the three-County area and Pinal County over the 50-year period. In the three-County area, estimated direct income impacts are over $2 billion and estimated secondary impacts are over $854,000 for the 50-year period. At the end of the study period in Pinal County, estimated direct income impacts are $1.2 billion and estimated secondary impacts are over $748,000.

Table D-99, Comparison of Income Impacts – Alternative 1 Versus No Action, reflects that estimated income impacts in the three-County area and Pinal County are greater under Alternative 1 than under the No Action Alternative over the 50-year period. For example, in the three-County area, estimated total direct impacts under Alternative 1 exceed those under No Action by about $72 million. Projected secondary impacts under Alternative 1 are about $29 million more than under No Action. In Pinal County, projected direct impacts under Alternative 1 are about $59 million more than under No Action, and projected secondary impacts exceed those under No Action by about $42 million.

D.VIII.e. Alternative 2

In the NIA sector, Table D-27, Composite District Analysis and Summary and Adjustments in Agricultural Output Due to Cropping Changes, shows that over the 50-year period an estimated 40,404 acres of grain go out of production in the IDs. Most of the loss in grain production, an estimated 35,297 acres, is projected to occur between 2030 and 2050. Over the 50-year period, forage acreage is projected to decline by 11,166 acres. The majority of losses in forage acreage are projected to occur between 2017 and 2030. Production of cotton, vegetable, and tree crops remains constant throughout the study period.

In Indian agriculture, Table D-31, Indian Agricultural Development and Production – 2001 through 2050, Alternative Two, reflects new TON and GRIC agricultural development to cover a maximum of 116,090 acres. Total TON acreage is projected to be 13,600 acres of cotton, vegetable, grain, forage, and tree crops. The TON acreage is projected to be fully developed by 2030. Total GRIC acreage is projected to cover 102,490 acres by 2030. Cotton and grain are projected to be cultivated on more than 85,000 acres of GRIC land.

D.VIII.e.1. Economic Impacts at the County Level – Alternative 2

Table D-101, Summary of Impacts of Agricultural Output Changes – Alternative 2, reflects that estimated net gains in agricultural output in the three-County area exceed $3.6 billion. Estimated losses in NIA output are about $681 million. In Pinal County, no impacts are projected until 2017. Overall, estimated net gains in output exceed $3 billion. NIA losses in output are projected to be about $434 million over the study period.

Compared to the No Action Alternative, Table D-101, Comparison of Impacts of Agricultural Output Changes-Alternative 2 Versus No Action, shows that positive impacts to output are

greater under Alternative 2 than under the No Action for the three-County and Pinal County areas except in 2017. In the three-County area, estimated total direct impacts are about $369 million more under Alternative 2 than under No Action. Estimated total secondary impacts under Alternative 2 exceed those under No Action by about $185.5 million. In Pinal County, estimated total direct output impacts are about $359 million more under Alternative 2 than under No Action. Estimated total secondary impacts are about $176 million greater under Alternative 2.

In terms of employment, Table D-102, Summary of Employment Impacts – Alternative 2, shows that positive job growth is projected to occur under this alternative in the three-County and Pinal County areas.

In the three-County area in 2004, the estimated direct employment impacts are negative with a loss of about 28 jobs. The estimated secondary employment impacts are positive but very small showing a gain in almost five jobs due to changes in agricultural output. In 2004, the losses and gains in agricultural output almost cancel each other out. An estimated 2,420 acres of TON cotton, grain, and forage lands are projected to come into production; 2,107 acres of forage in HVID are projected to go out of production. In the three-County area, the impacts to employment from these changes are minimal. At the end of the 50-year period, the estimated total employment impacts in Alternative 2 for the three-County area are about 54,000 person-years of employment. Approximately 24,000 person-years of employment are projected to be created in sectors that serve agricultural demand. Pinal County shows no projected change in employment until after 2017. The 50-year estimate for Pinal County employment impacts is over 50,000 person-years of employment created including about 31,000 person-years of employment created in economic sectors that support agriculture.

Compared to the No Action Alternative, Table D-103, Comparison of Employment Impacts – Alternative 2 Versus No Action, shows that, in the three-County area, estimated employment impacts under the two alternatives were identical for 2001 through 2017. After 2017, positive direct employment impacts are greater under the No Action Alternative than under Alternative 2. However, under Alternative 2, secondary employment impacts are slightly higher than under the No Action Alternative in the three-County area. Total 50-year estimated employment impacts for the three-County area under Alternative 2 are greater than the total estimated employment impacts under No Action by about 2,300 person-years of employment. In Pinal County there are no quantifiable differences in estimated employment impacts between the two alternatives from 2001 to 2017. Total estimated positive employment impacts in Pinal County are slightly higher under Alternative 2 than under the No Action Alternative by about 3,800 person-years of employment over the 50-year period.

Table D-104, Summary of Income Impacts – Alternative 2, reflects that the three-County area and Pinal County are projected to experience income growth under this alternative. No growth associated with changes in agricultural production is projected to occur in Pinal County until 2017. The total income impacts to the three-County area are projected to be $3.1 billion and $2.1 billion in Pinal County.

Table D-105, Comparison of Income Impacts – Alternative 2 Versus No Action, shows that Alternative 2 would have higher estimated positive impacts to income in both the three-County

area and Pinal County than the No Action Alternative over the 50-year period. The difference in estimated total income impacts for the three-County area is about $320.6 million. In Pinal County the difference in estimated total income impacts between this alternative and the No Action Alternative is almost $233 million.

D.VIII.f. Alternative 3a

Table D-27, Composite District Analysis and Summary and Adjustments of Agricultural Output Due to Cropping Changes, shows NIA grain acreage is projected to decline 40,404 acres over the 50-year period. The greatest decline in grain acreage, 22,823 acres, is projected to occur between 2030 and 2043. NIA forage production in Alternative 3a declines most rapidly between 2017 and 2030, when 5,449 acres are projected to go out of production. Over the 50-year period, 11,166 acres of forage are projected to go out of production.

Under Alternative 3a, Table D-32, Indian Agricultural Development and Production – 2001 through 2050, Alternative 3a, total new TON acreage is 13,600 acres. The TON is projected to develop all of the acreage by 2030. The GRIC are projected to develop 136,822 additional acres. All of the acreage is projected to be developed by 2030. Total additional GRIC and TON acreage under Alternative 3a is projected to be 150,422 acres.

D.VIII.f.1. Economic Impacts at the County Level – Alternative 3a

Table D-106, Summary of Impacts of Agricultural Output Changes – Alternative 3a, reflects that estimated net total direct output impacts and secondary output impacts are positive in the three-County area and in Pinal County. In the three-County area, at the end of the study period, net total direct impacts are projected to be $4.7 billion. Estimated NIA impacts are a negative $703 million. Estimated Indian impacts are $4.2 billion. Total secondary impacts are almost $2.2 billion. In Pinal County, net impacts to output are also positive and similar in magnitude to the three-County impacts. Net total direct impacts in Pinal County are projected to be almost $4.6 billion. Losses to NIA are projected to be $434 million. Impacts to Indian agriculture are projected to be $5 billion. Total secondary impacts to output in Pinal County are estimated to be almost $2 billion. In Pinal County, no output impacts are observed in 2001 and 2004 because no changes in agricultural production are projected to occur.

Table D-107, Comparison of Impacts of Agricultural Output Changes – Alternative 3a Versus No Action, compares the impacts from estimated output changes under Alternative 3a and the No Action Alternative. The net positive impacts from changes in output over the 50-year period are greater under Alternative 3a than under the No Action Alternative predominantly due to the greater number of additional Indian acres coming into production. Estimated total direct impacts under Alternative 3a are almost $1.5 billion greater than under No Action. Estimated impacts from Indian output are about $1.7 billion greater than Indian impacts under No Action. Estimated secondary impacts in the three-County area exceed secondary impacts under No Action by about $676 million. However, NIA is projected to experience $294 million more losses in output under Alternative 3a than under the No Action Alternative. Overall, Pinal County also compares favorably to the No Action Alternative. Total direct impacts are greater than under the No Action Alternative by almost $1.5 billion. Impacts from Indian output are almost $1 billion greater under Alternative 3a than under the No Action Alternative.

Secondary impacts due to changes in agricultural output under Alternative 3a are estimated to be $373 million more than under the No Action Alternative. NIA losses, however, are higher under Alternative 3a than under No Action by about $185 million over the 50-year period.

Table D-108, Summary of Employment Impacts – Alternative 3a, reflects that this alternative is characterized by job growth. Over the 50-year period, total employment impacts in the three-County area are projected to be over 71,000 person-years of employment. Estimated secondary employment impacts are almost 31,000 person-years of employment. In 2001 and 2004, no employment impacts are observed in Pinal County because agricultural output does not change. In Pinal County, almost 66,000 person-years of employment are also projected by the end of the study period. Estimated secondary employment impacts over the study period in Pinal County are almost 40,000 person-years of employment.

Compared to the No Action Alternative, Table D-109, Comparison of Employment Impacts – Alternative 3a Versus No Action, shows that overall, agricultural output under Alternative 3a is projected to generate more job growth than agricultural production under the No Action Alternative for the three-County area and Pinal County. In the three-County area, no differences in employment impacts are observed between the two alternatives in 2001 and 2004. In 2017, job growth is less in Alternative 3a than in the No Action Alternative. Over the 50-year period, estimated direct employment impacts are almost 11,000 person-years of employment. Estimated secondary impacts to employment are projected to be about 10,000 person-years of employment. In Pinal County, no differences in employment impacts are observed between Alternative 3a and the No Action Alternative. Over the 50-year period, estimated direct employment impacts are about 8,000 person-years of employment, and estimated secondary employment impacts approximately 13,000 person-years of employment.

Table D-110, Summary of Income Impacts – Alternative 3a, reflects positive income impacts in each indicator year of the study period for the three-County area. Total income impacts for the three-County area over the study period are estimated to be over $2.8 billion. Estimated secondary impacts exceed $1.2 billion. In Pinal County, in 2001 and 2004, no impacts to income are observed because no changes in agricultural production are projected to occur. Over the 50-year period, total income impacts are projected to be over $1.7 billion, and secondary impacts are estimated to be more than $1 billion.

Table D-111, Comparison of Income Impacts – Alternative 3a Versus No Action, reflects, in the three-County area, that Alternative 3a has greater positive impacts to income overall, though 2017 shows lower income in Alternative 3a. At the end of the 50-year period, estimated income impacts in the three-County area surpass those in the No Action Alternative by almost $890 million. Estimated secondary income impacts in Alternative 3a surpass those of the No Action Alternative by almost $378 million. In Pinal County, no differences in income impacts between Alternative 3a and the No Action Alternative are observed from 2001 through 2017. Estimated total direct income impacts over the study period exceed those under the No Action Alternative by more than $557 million. Estimated total secondary impacts under Alternative 3a exceed estimated secondary impacts under No Action by more than $347 million.

D.VIII.g. Alternative 3b

Under Alternative 3b, Table D-27, Composite District Analysis and Summary and Adjustments of Agricultural Output Due to Cropping Changes, shows that total decline in NIA grain acres over the 50-year period is projected to be 40,404 acres. The greatest loss in grain acres is projected to occur between 2017 and 2030, when 22,823 acres of grain go out of production. NIA forage acres decline from 26,466 in 2001, to 15,300 in 2030. After 2030, no more forage acreage is projected to go out of production.

Table D-33, Indian Agricultural Development and Production – 2001 through 2050, provides the projected cropping patterns for TON and GRIC. Under Alternative 3b, the TON are projected to develop 13,600 acres. The new TON acreage is projected to be fully developed and in production by 2030. The GRIC are projected to develop 136,822 acres under Alternative 3b. The new GRIC acres are fully developed and in production by 2030 as well. Total TON and GRIC acreage is projected to be 150,422 acres. The predominant crops are expected to be cotton, grains, and forage.

D.VIII.g.1. Economic Impacts at the County Level – Alternative 3b

Table D-112, Summary of Impacts of Agricultural Output Changes – Alternative 3b, shows that total net impacts over the 50-year period are estimated to be over $4.6 billion. Total secondary impacts are projected to be $2.1 billion. NIA losses of output are estimated to be $768 million. Gains in Indian output are estimated to be $5.4 billion. No agricultural output impacts are expected to occur in Pinal County in 2001 and 2004. Overall, estimated total direct impacts in Pinal County exceed $4.46 billion for the 50-year period. NIA losses in output are projected to be over $551 million. Indian gains in output are projected to be $5 billion. Secondary impacts in Pinal County are projected to be $1.9 billion.

Table D-113, Comparison of Impacts of Agricultural Output Changes – Alternative 3b Versus No Action, compares the impacts of changes in agricultural output in Alternative 3b and the No Action Alternative. Table D-113, shows that agricultural production in Alternative 3b is projected to provide higher estimated total net direct impacts in the three-County area than agricultural production under the No Action Alternative. Alternative 3b reflects greater direct impacts because gains in Indian agricultural output are higher under Alternative 3b than under the No Action Alternative. Under Alternative 3b, NIA is projected to experience greater losses than under the No Action Alternative by about $389 million. Total secondary impacts are estimated to be $639 million. Table D-113 shows that, in Pinal County, the estimated net direct impacts under Alternative 3b are $1.3 billion greater than estimated net direct impacts under the No Action Alternative. NIA output losses in Pinal County are estimated to be about $302 million higher than NIA losses under the No Action Alternative by the end of the study period. Estimated total secondary impacts in Pinal County are about $603 million higher in Alternative 3b than those under the No Action Alternative.

Table D-114, Summary of Employment Impacts – Alternative 3b, shows that jobs increase overall in the three-County area and Pinal County due to agricultural production. At the end of the 50-year period, estimated total employment impacts in the three-County area are more than 69,000 person-years of employment. Estimated secondary employment impacts are more than

30,000 person-years of employment. Pinal County reflects no employment impacts in 2001 and 2004 due to the absence of projected changes in agricultural production. Estimated total direct employment impacts in Pinal County are more than 26,000 person-years of employment at the end of the study period. Estimated secondary employment impacts are more than 39,000 person-years of employment at the end of the study period.

Table D-115, Comparison of Employment Impacts – Alternative 3b Versus No Action, compares estimated employment impacts under Alternative 3b and the No Action Alternative over the study period. Table D-115 reflects that projected agricultural production under Alternative 3b would create more new jobs than agricultural production under the No Action Alternative in the three-County area and Pinal County. In the three-County area, total employment impacts under Alternative 3b are projected to create about 18,400 more person-years of employment than those under the No Action Alternative over the 50-year period. Secondary employment impacts are projected to exceed those under the No Action Alternative by about 9,200 person-years of employment over the 50-year period. In the early part of the study period, 2001 through 2004, no differences in employment impacts between the two alternatives are projected. In Pinal County, agricultural production under Alternative 3b is projected to create almost 19,000 more person-years of employment by the end of the study period. Estimated secondary impacts exceed estimated secondary impacts under the No Action Alternative by about 12,400 person-years of employment. From 2001 through 2017, there are no observable differences in employment impacts between the two alternatives.

Table D-116, Summary of Income Impacts – Alternative 3b, reflects positive direct and secondary income impact for the three-County area and Pinal County. Total projected income impacts in the three-County area are projected to be $4 billion over the study period. Estimated secondary impacts are almost $1.2 billion. In Pinal County, total income impacts are projected to be $2.7 billion, with secondary impacts projected to exceed $1 million over the study period. In Pinal County, no income impacts are projected from 2001 through 2004 because minimal change in agricultural production is projected to occur due to reallocation of CAP water.

Table D-117, Comparison of Income Impacts-Alternative 3b Versus No Action, reflects that the three-County area and Pinal County are projected to experience greater positive impacts to income under Alternative 3b than under the No Action Alternative over the 50-year period. For example, in the three-County area, estimated total income impacts in the three-County area exceed total income impacts under No Action by almost $1.2 billion. Estimated secondary income impacts under Alternative 3b exceed estimated secondary income impacts under No Action by more than $357 million. However, no differences in estimated income impacts are observed between the two alternatives in 2001 and 2004. In 2017, slightly more gains in income are projected under the No Action Alternative. From 2001 through 2017, in Pinal County, no differences in estimated income impacts are observed between the two alternatives. Over the study period, in Pinal County, estimated total income impacts exceed those under the No Action Alternative by more than $837 million, and estimated secondary impacts exceed those under No Action by more than $322 million.

D.IX. ESTIMATED IMPACTS ON GROUNDWATER PUMPING COSTS IN SELECTED IRRIGAITON DISTRICTS – 2001 to 2050

A brief analysis was conducted to determine the impact on groundwater pumping costs over the study period given projected groundwater levels that may occur under each alternative. This analysis relies on information regarding the projected groundwater levels, and methodology to project the levels are in Chapter IIIB and Appendix I of this Draft EIS. The groundwater analysis determined the groundwater levels that would occur under the No Action Alternative and the other alternatives. Next the groundwater analysis calculated the difference in groundwater levels between the No Action Alternative and the other alternatives. Upon completion of the groundwater analysis, groundwater pumping cost data were applied to see the difference in cost between pumping groundwater under the No Action Alternative and pumping under the other alternatives at the end of the study period. Impacts on groundwater pumping costs were estimated for certain IDs under each alternative over the 50-year study period and compared to the No Action Alternative. Table D-118, Estimated Impacts on Groundwater Pumping Costs in Selected IDs- 2001 through 2050, reflects the increase or decrease in pumping costs for MSIDD, CAIDD, HIDD, NMIDD, and QCIDD under each alternative, compared to the No Action Alternative, between 2001 and 2050.

Table D-118 shows mixed results for the IDs. For example, QCID and NMIDD are projected to experience higher pumping costs under all alternatives compared to the No Action Alternative. Increases in pumping costs are considered equivalent to a loss, thus, the values are preceded by a negative sign. For MSIDD and CAIDD, pumping costs are projected to be higher under the Settlement Alternative and Alternatives 2 and 3b compared to the No Action Alternative. Under Alternatives 1 and 3a, MSIDD and CAIDD are projected to experience a cost savings because pumping costs are projected to be lower under these alternatives than under the No Action Alternative. For HIDD, pumping costs are projected to be higher under Alternatives 2, 3a, and 3b than under the No Action Alternative. Pumping costs are projected to be lower in the Settlement Alternative and Alternative 1 for HIDD. Over the 50-year period, the estimated cost increases are fairly large and range from about $312,000 for HIDD in Alternative 2 to about $16.7 million under the Settlement Alternative for QCID. Over the same period, the estimated cost savings ranges from almost $34,000 for CAIDD under Alternative 1 to more than $6 million for MSIDD under Alternative 3a.

A P P E N D I X D

T A B L E S